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US DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEYS DOCKET NUMBER
P99,2301

U.S.APPLICATION NO. (if known, see 37 CFR 1.5)
09/423454

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE98/01276	**May 7, 1998**	**May 7, 1997**

TITLE OF INVENTION **METHOD AND ARRANGEMENT FOR ENCODING AND DECODING A DIGITIZED IMAGE WITH PICTURE ELEMENTS (AS AMENDED)**

APPLICANT(S) FOR DO/EO/US **ROBERT KUTKA and STATHIS PANIS**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of International Application (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2).

7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.

8. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)) **(attached at back of English translation of application)**.

9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report)**.

12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.
    (SEE ATTACHED ENVELOPE)

13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.

14. ☐ A substitute specification.

15. ☐ A change of power of attorney and/or address letter.

16. ☒ Other items or information:
    a. ☒ Submission of Drawings
    b. ☒ Request for Approval of Drawing Changes
    c. ☐ Letter Under Rule Under 37 C.F.R. §1.41(c)
    d. ☒ EXPRESS MAIL #EL412789839US

U.S.APPLICATION NO. (if known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/423454	PCT/DE98/01276	P99,2301

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO ..... $840.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) ... $760.00 No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) ..... $450.00 Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO ..... $1,250.00 International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... $ 98.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 840.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$	

Claims	Number Filed		Number Extra	Rate		
Total Claims	26	- 20 =	6	X $ 18.00	$ 108.00	
Independent Claims	4	- 3 =	1	X $ 78.00	$ 78.00	
Multiple Dependent Claims				$270.00 +	$	
TOTAL OF ABOVE CALCULATIONS =					$1,026.00	
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$	
SUBTOTAL =					$1,026.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					$	
TOTAL NATIONAL FEE =					$	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property +					**SEE ATTACHED ENVELOPE**	
TOTAL FEES ENCLOSED =					$1,026.00	
					Amount to be refunded	$
					charged	$

a. ☒ A check in the amount of $ 1,026.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **08-2290**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE

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Registration Number

BOX PCT

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE

OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER THE PATENT COOPERATION TREATY-CHAPTER II

REQUEST FOR APPROVAL OF DRAWING CHANGES

APPLICANT(S):	Robert Kutka et al.
ATTORNEY DOCKET NO.:	P99,2301
INTERNATIONAL APPLICATION NO.:	PCT/DE98/01276
INTERNATIONAL FILING DATE:	07 May 1998
INVENTION:	"METHOD AND ARRANGEMENT FOR ENCODING AND DECODING A DIGITIZED IMAGE WITH PICTURE ELEMENTS" (Title as amended)

Assistant Commissioner for Patents

Washington, D.C. 20231

S I R:

Applicant herewith requests approval of the drawing changes in FIG. 1D as shown on the drawing copies marked in red attached hereto.

Submitted by,

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BOX PCT

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE

OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER THE PATENT COOPERATION TREATY-CHAPTER II

AMENDMENT "A" PRIOR TO ACTION

APPLICANT(S):	Robert Kutka et al.
ATTORNEY DOCKET NO.:	P99,2301
INTERNATIONAL APPLICATION NO.:	PCT/DE98/01276
INTERNATIONAL FILING DATE:	07 May 1998
INVENTION:	"METHOD AND ARRANGEMENT FOR ENCODING AND DECODING A DIGITIZED IMAGE WITH PICTURE ELEMENTS" (Title as amended)

Assistant Commissioner for Patents

Washington, D.C. 20231

Sir:

Applicants herewith amend the above-referenced PCT application, and request entry of the Amendment prior to examination on the United States National Examination Phase.

IN THE SPECIFICATION:

On page 1, cancel the title above line 3, and insert the following above line 3:

--TITLE

METHOD AND ARRANGEMENT FOR ENCODING AND DECODING A DIGITIZED IMAGE WITH PICTURE ELEMENTS

BACKGROUND OF THE INVENTION

The present invention is directed to a method and an arrangement for encoding and decoding a digitized image with picture elements.--;

in line 3, cancel ", respectively,";

in line 4, cancel "digitalized" substitute --digitized-- therefor;

in line 7, cancel "[1]" substitute --S. Hofmeir, "Multimedia fur

unterwegs", Funkschau, No. 7, 1996, pp. 75-77-- therefor;

in line 8, cancel "[2] MPEG, [3] (H.263) and [4] (JPEG)" substitute -- D. Le Gall, "MPEG: A Video Compression Standard for Multimedia Applications", Communications of the ACM, Vol. 34, No. 4, April 1991, pp. 47-58 (MPEG); M. Liou "Overview of the px64 kbits/s Video Coding Standard", Communications of the ACM, Vol. 34, No. 4, April 1991, pp. 60-63 (H.263); and G. Wallace, "The JPEG Still Picture Compression Standard", Communications of the ACM, Vol. 34, No. 4, April 1991, pp. 31-44 (JPEG)-- therefor;

in line 18, cancel the comma;

in line 19, cancel "respectively,";

in line 21, cancel the comma;

in line 22, cancel "respectively,".

On page 2, in line 1, cancel "[5]" substitute --W. Gerod et al., "Spatial Shaping: A Fully Compatible Improvement of DCT-Coding", Picture Coding Symposium, Lausanne, France, 1993-- therefor;

in line 3, cancel "[6]" substitute --R. Kutka, A. Kaup and M. Hager, "Quality Improvement of Low Data-Rate Compressed Signals by Pre- and Postprocessing", Digital Compression Technologies and Systems for Video Communications, SPIE, Vol. 2952, 07-09 October 1996, pp. 42-49-- therefor;

in line 6, cancel "[7]" substitute --S. Minami and A. Zakhor, "An Optimization Approach for Removing Blocking Effects in Transform Coding", IEEE Transactions on Circuit Systems Video Technology, Vol. 5, No. 2, April 1995, pp. 74-82-- therefor;

in line 8, cancel "[8]" substitute --H.245 Standard, ITU Standard Recommendation-- therefor;

in line 10, cancel ", respectively,";

in line 11, cancel "[9]" substitute --German Patent Application No. 196 040 50-- therefor;

below line 17, insert a centered heading:

--**SUMMARY OF THE INVENTION**--;

in line 18, cancel "The invention is based on the problem of specifying" substitute --It is an object of the present invention to provide an arrangement and -- therefor;

in line 19, cancel "digitalized" substitute --digitized-- therefor;

cancel line 22;

insert the following paragraph at line 22:

--This object is inventively achieved in accordance with the present invention in a method for encoding a digitized image having picture elements, the method comprising the steps of:

grouping all except at least one picture elements of a digitized image into a number of image segments, the at least one ungrouped picture element being from at least one area of the image located between image segments; and

encoding only the picture elements being grouped into an image segment.--;

in line 23, cancel "Given the method according to patent claim 1, the digitalized" substitute --In an embodiment, the digitized-- therefor;

in line 24, cancel "plurality" substitute --number-- therefor.

On page 3, in line 1, cancel "Given the method according to patent claim 2" substitute --In an embodiment-- therefor;

in line 7, cancel "Given the method according to patent claim 3" substitute --In an embodiment, in a method-- therefor;

in line 8, cancel "digitalized" substitute --digitized-- therefor, and

cancel "plurality" substitute --number-- therefor;

in line 19, preceding "method" insert --present--;

in line 24, cancel ", respectively,";

cancel lines 26-27;

in line 28, cancel "It" substitute --In an embodiment, it-- therefor, and cancel "as";

in line 29, cancel "filtering".

On page 4, in line 3, cancel "It" substitute --In an embodiment, it-- therefor;

in line 7, cancel "It" substitute --In an embodiment, it-- therefor, and cancel "in a development";

in line 10, cancel "The" substitute --In an embodiment, the-- therefor;

in line 14, cancel "and -" substitute --and,-- therefor;

in line 16, cancel "In" substitute --In an embodiment, in-- therefor;

in line 18, cancel "It" substitute --In an embodiment, it-- therefor;

in line 21, cancel "It" substitute --In an embodiment, it-- therefor;

in line 27, cancel "An" substitute --In an embodiment, an-- therefor, and preceding "method" insert --present--.

On page 5, cancel lines 3-11, substitute the following at line 3:

-- These and other features of the invention(s) will become clearer with reference to the following detailed description of the presently preferred embodiments and accompanied drawings.

DESCRIPTION OF THE DRAWINGS

FIGs. 1A through 1F show the method for encoding and decoding a symbolically presented digitized image having image blocks in accordance with the present invention.

FIG. 2 is a block diagram of an arrangement comprising a camera, two computers and two picture screens constructed and operated in accordance with the present invention.

FIG. 3 is a block circuit diagram showing the integration of the present method into the method according to the H.263 standard.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS--;

in line 13, cancel "digitalized" substitute --digitized-- therefor, and cancel "that are";

in line 14, cancel "supplied";

in line 18, cancel the comma;

in line 19, cancel "respectively,";

in line 27, cancel "1a" substitute --1A-- therefor.

On page 6, in line 1, cancel "1b" substitute --1B-- therefor;

in line 9, cancel "1c" substitute --1C-- therefor;

in line 10, cancel "1b" substitute --1B-- therefor, and cancel "1c" substitute --1C-- therefor;

in line 16, after "as" insert --an--;

in line 18, cancel "(Step 101; see Figure 1d)" substitute --(see Figure 1D)-- therefor;

in line 21, cancel "RB" substitute --BR-- therefor, and cancel "1e" substitute --1E-- therefor;

in line 25, cancel "1f" substitute --1F-- therefor;

in line 29, after "block" insert --BB--.

On page 7, in line 1, after "elements" insert --BP--;

in line 4, cancel "1e" substitute --1E-- therefor, and cancel "1f" substitute --1F-- therefor;

in line 5, cancel "1e" substitute --1E-- therefor, and cancel "1f" substitute --1F-- therefor;

in line 15, cancel "plurality" substitute --number-- therefor;

in line 17, after "low-pass" insert --filter--;

cancel line 21;

in line 24, after "elements" insert --BP--;

in line 25, cancel "plurality" substitute --number-- therefor;

in line 26, cancel ", respectively,".

On page 8, in line 1, cancel "a possibility" substitute --an embodiment-- therefor;

below line 20, insert the following paragraph:

-- Although modifications and changes may be suggested by those of ordinary skill in the art, it is the intention of the inventors to embody within the patent warranted hereon all changes and modifications as reasonably and properly come within the scope of their contribution to the art.--.

Cancel page 9.

IN THE CLAIMS:

On substitute page 10, in line 1, cancel "**Patent Claims**" substitute --**WE CLAIM AS OUR INVENTION:**-- therefor.

Please cancel substitute claims 1-26 and substitute the following claims 27-52 therefor:

27. A method for encoding a digitized image having picture elements, said method comprising the steps of:

grouping all except at least one picture elements of a digitized image into a number of image segments, said at least one ungrouped picture element being from at least one area of said image located between image segments; and

encoding only said picture elements being grouped into an image segment.

28. A method for encoding and decoding a digitized image having picture elements, said method comprising the steps of:

grouping all except at least one picture elements of a digitized image into a number of image segments in a first arrangement, said at least one ungrouped picture element being from at least one area of said image located between image segments;

encoding said image in said first arrangement by only encoding said picture elements being grouped into an image segment;

transmitting said encoded image segments from said first arrangement to a second arrangement;

decoding said transmitted image segments in said second arrangement;

inserting new picture elements corresponding to said non-encoded picture elements of said encoded image in said second arrangement in an area between said decoded image segments;

interpolating said area between said image segments in said second arrangement; and

allocating encoding information resulting from said interpolating to said new picture elements.

29. The method according to claim 27, further comprising the step of:

prior to encoding said grouped picture elements, filtering said image to be encoded.

30. Method according to claim 28, wherein said interpolation is performed by low-pass filtering.

31. The method according to claim 28, further comprising the step of:

prior to encoding said grouped picture elements, filtering said image to be encoded; and

wherein said interpolation is performed by low-pass filtering.

32. The method according to claim 30, wherein said low-pass filtering is performed essentially at edges of said image segments.

33. The method according to claim 30, wherein said filtering is performed after said decoding.

34. The method according to claim 33, wherein said filtering is performed essentially at edges of said image segments.

35. The method according to claim 27, wherein said image segments are image blocks.

36. The method according to claim 35, wherein at least respectively one picture element is not grouped into any image block between said image blocks.

37. The method according to claim 28, wherein said interpolating is performed by a number of filters.

38. The method according to claim 37, wherein said filters have characteristics dependent on an image quality of an image block; and wherein a strength characteristic of a filter increases with a reduction of said image quality of said image block.

39. The method according to claim 37, wherein said filters have characteristics dependent on a motion vector of an image block; and wherein a strength characteristic of a filter increases with a size of a motion vector being allocated to a respective image block.

40. The method according to claim 27, wherein said encoding is according to the H.263 standard.

41. The method according to claim 28, wherein said encoding is according to the H.263 standard; and wherein said encoded image is transmitted from said first arrangement to said second arrangement by employing a capability table according to the H.245 standard.

42. The method according to claim 27, further comprising the step of:

implementing a motion compensation upon said digitized image.

43. An arrangement for encoding a digitized image having picture elements, said arrangement comprising:

a processor unit having a processor and a memory including a program comprising the steps of:

grouping all except at least one picture elements of a digitized image into a number of image segments, said at least one ungrouped picture element being from at least one area of said image located between image segments; and

encoding only said picture elements being grouped into an image segment.

44. An arrangement for encoding and decoding a digitized image having picture elements, said arrangement comprising:

a first arrangement having a first processor unit comprising a processor and a memory including a program comprising the steps of:

grouping all except at least one picture elements of a digitized image into a number of image segments, said at least one ungrouped picture element being from at least one area of said image located between image segments; and

encoding said image by only encoding said picture elements being grouped into an image segment;

a transmitter for transmitting said encoded image from said first arrangement to a second arrangement;

a second arrangement having a second processor unit comprising a processor and a memory including a program comprising the steps of:

decoding said transmitted image segments;

inserting new picture elements corresponding to said non-

encoded picture elements of said encoded image in said second arrangement in an area between said decoded image segments;

interpolating said area between said image segments in said second arrangement; and

allocating encoding information resulting from said interpolating to said new picture elements.

45. The arrangement according to claim 44, wherein said second processor unit is programmed to interpolate by low-pass filtering.

46. The arrangement according to claim 43, wherein said first processor unit is programmed to realize said image segments as image blocks, and wherein at least respectively one picture element is not grouped into any image block between said image blocks.

47. The arrangement according to claim 44, wherein said second processor unit is programmed to perform said interpolating by a number of filters.

48. The arrangement according to claim 47, wherein said wherein said filters have characteristics dependent on an image quality of an image block; and wherein a strength characteristic of a filter increases with a reduction of said image quality of said image block.

49. Arrangement according to claim 47, wherein said filters have characteristics dependent on a motion vector of an image block; and wherein a strength characteristic of a filter increases with a size of a motion vector being allocated to a respective image block.

50. The arrangement according to claim 43, wherein said first

processor unit is programmed to encode according to the H.263 standard.

51. The arrangement according to claim 45, wherein said first processor unit is programmed to encode according to the H.263 standard; and wherein said encoded image is transmitted from said first arrangement to said second arrangement by employing a capability table according to the H.245 standard.

52. The method according to claim 43, wherein said first processor unit is programmed to implement a motion compensation upon said digitalized image.

IN THE ABSTRACT:

On page 15, in line 1, cancel "**Abstract**" substitute the following centered heading therefor:

--**ABSTRACT OF THE DISCLOSURE**--;

cancel lines 2-8, substitute the following abstract at line 2:

--A method and an arrangement in which a digitized image with picture elements is allocated to a number of image segments. The image segments, preferably image blocks, are spread such that interspaces remain between the image blocks to be encoded. The interspaces are interpolated after decoding.--.

REMARKS:

The present Amendment revises the specification, drawings and claims to conform to United States patent practice, before examination of the present PCT application in the United States National Examination Phase. All of the changes are editorial and no new matter is added thereby. The cancellation of claims 1-26, in favor of new claims 27-52, has been made solely for convenience, since the amount of bracketing and underlining necessary to editorially amend claims 1-26 in order to conform to United States patent practice would have been excessive and burdensome. The cancellation of claims 1-26 is therefore not intended to be a surrender of any of the subject matter of those claims.

Early examination on the merits is respectfully requested.

Respectfully submitted,

Steven H. Noll (Reg. No. 28,982)

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METHOD FOR ENCODING AND DECODING A DIGITALIZED IMAGE WITH PICTURE ELEMENTS

In image compression methods for encoding or, respectively, decoding digitalized images, the images are usually divided into image segments.

A distinction is made between two approaches for image encoding, object-based image encoding and block-based image encoding. Object-based methods for image encoding are described in [1]. An overview of block-based image encoding methods can be found in [2] MPEG, [3] (H.263) and [4] (JPEG).

Given block-based image encoding methods, the image is divided into what are referred to as image blocks that usually comprise a rectangular shape and respectively comprise 8x8 or 16x16 picture elements. In the known methods, the blocks are transformed with the assistance of a transformation encoding, preferably discrete cosign transformation (DCT), wavelet transformation or a transformation with vector quantization.

Losses in the image quality must be accepted in the transmission of moving images over narrow-band channels such as, for example, 40 kbit/sec or lower for picture telephony applications. The most noticeable disturbances are the brightness discontinuities known as block artifacts in block-based image encoding or, respectively, as object edge artifacts in object-based image encoding, i.e. the abrupt changes of the values of the encoding information that is allocated to the individual picture elements produced by discontinuity points at the image block edges or, respectively, at the image object edges.

What is to be understood below by encoding information is, for example, luminance information or chromance information that is respectively unambiguously allocated to the picture elements.

Two different approaches are known in order to reduce the block artifacts.

The first approach is based on corrections in the frequency domain of the spectral transformation. A method referred to as spatial shaping reduces the edge artifacts at the expense of the image quality in the interior of the block. This method

is known from [5]. Another method that is based on corrections in the frequency domain employs the prediction of the DCT coefficients. Although the quality in the interior of the block is improved by this procedure described in [6], the block artifacts are only partially reduced.

The second approach for reducing block artifacts is based on corrections in the location domain. [7] discloses that the picture elements at the block edges be subjected to a low-pass filtering, as a result whereof the discontinuity points are smoothed and appear less disturbing. [8] discloses that different filters be employed for different image blocks, dependent, for example, on the quantization of the image block or, respectively, dependent on the motion vector.

[9] discloses a method for controlling various transmission parameters in the framework of the H.263 standard, which is referred to as J.245 standard. It is known within the framework of the H.245 standard to inform a second arrangement with which communication is desired of specific transmission properties from a first arrangement via what is referred to as a capability table wherein the respective feature that is to be employed within the framework of the communication connection is indicated.

The invention is based on the problem of specifying methods for encoding and for decoding a digitalized image with which the required transmission capacity is reduced compared to known methods without the image quality being noticeably deteriorated.

The problem is solved by the methods according to patent claim 1, 2, 3.

Given the method according to patent claim 1, the digitalized image, which comprises picture elements, is divided into a plurality of image segments. The division, i.e. the grouping, ensues such that at least one picture element is not allocated to an image segment for at least a part of the image between image segments. Only the picture elements that were allocated to an image segment are in fact encoded.

Given the method according to patent claim 2, an encoded image having picture elements that are allocated to image segments are decoded in that the image segments are decoded and new picture elements corresponding to non-encoded picture elements of the encoded image are inserted between the decoded image segments. An interpolation is implemented between the image segments, as a result whereof encoding information is allocated to the new picture elements.

Given the method according to patent claim 3 for encoding and decoding of a digitalized image, the picture elements are again grouped into a plurality of image segments. The grouping ensues such that at least one picture element is not allocated to an image segment for at least a part of the image between image segments. Only the picture elements that were allocated to an image segment are encoded. The encoded image segments are transmitted and the image segments are decoded. New picture elements corresponding to the non-encoded picture elements of the encoded image are inserted between the decoded image segments. A filtering is undertaken between the image segments, as a result whereof encoding information is allocated to the new picture elements.

The invention can clearly be seen therein that the transmission of image lines and image columns between image segments, for example between image blocks is foregone in the method. The block grid upon employment of a block-based image encoding method is spread such that interspaces remain between the image blocks to be encoded, and the interspaces are interpolated after the decoding.

As a result of this procedure, the required transmission capacity is reduced without the image quality in the interior of the image segment being noticeably deteriorated. Further, the block artifacts or, respectively, the edge artifacts of the image objects are considerably reduced.

Advantageous improvements of the invention derive from the dependent claims.

It is advantageous to apply a low-pass filtering to the image segments as filtering, as a result whereof a good smoothing of the image segment edges is

achieved. It is thereby advantageous for saving required calculating time to implement the filtering essentially at the image segment edges.

It is also advantageous to implement a further filtering of the image to be encoded before the spreading and the encoding. The further filtering corresponds to a sub-sampling filtering as employed when sub-sampling images for improving the image quality.

It is also advantageous in a development to implement an interpolation filtering after the decoding, this taking effect essentially at the image segment edges. This corresponds to an over-sampling filter, as utilized when enlarging images.

The method can be very simply implemented given block-based image encoding methods wherein the image segments are image blocks. At least respectively one picture element is not allocated to an image block between the image blocks. A very simple division of the picture elements into the image blocks is thus achieved and - connected therewith, a very simple selection of picture elements not to be encoded is achieved.

In order to further enhance the quality of the decoded image, it is advantageous to employ different filters for different image segments.

It is thereby advantageous to select the filters dependent on the image quality of an image block, whereby the strength of the filter employed increases with the reduction of the image quality of the image block.

It is also advantageous to select the different filters dependent on the motion vector of an image block, whereby the strength of the filter employed increases with the size of the motion vector that is allocated to the respective image block.

The method is very well-suited for utilization for image encoding according to the H.263 standard.

An advantageous possibility for integration of the method into the H.263 standard is the employment of the capability table according to the H.245 standard, wherein the option for implementation of this method is entered as a separate

performance feature and becomes possible within the framework of the communication control that is implemented according to the H.245 standard.

The figures describe an exemplary embodiment of the invention which is explained in greater detail below.

Shown are:

Figure 1 through 1f the principle of the method for a symbolically presented digitalized image having image blocks;

Figure 2 an arrangement comprising a camera, two computer arrangements and two picture screens with which the method can be implemented;

Figure 3 a block circuit diagram with which the integration of the method into the method according to the H.263 standard is symbolically shown.

Figure 2 shows a camera K that is connected to a first computer R1 via a connection V. The camera K supplies a sequence of digitalized images B that are supplied to the first computer R1. The first computer R1, just like a second computer R2, comprises a processor P as well as a memory S for storing the image data that are connected to one another via a bus BU. The first computer R1 and the second computer R2 are connected to one another via a line L. The first computer R1 and the second computer R2 are respectively connected to a first picture screen BS1 or, respectively, to a second picture screen BS2 for the presentation of the images B registered by camera K and potentially encoded and decoded.

The camera K registers a scene and supplies it as a sequence of images B to the first computer R1, and this is encoded in the first computer R1 according to the method for encoding that is set forth below. The encoded images CB are transmitted via the line L to the second computer R2 and are decoded in the second computer R2 according to the method for decoding the encoded digital images CB that is set forth below.

An image B is symbolically shown in Figure 1a. The image B in Figure 1a is subdivided into image blocks BB having respectively 8x8 picture elements BP. This is the standard procedure in block-based image encoding.

Figure 1b shows the image B with picture elements BP that are in turn grouped into image blocks BB each having respectively 8x8 picture elements BP. However, a respective interspace Z of at least one picture element BP is provided between the individual image blocks BB. The picture elements BP that are located in the interspace Z are not encoded, as explained below.

This obviously means that the picture elements BP of the interspaces Z are simply "omitted" in the encoding. By deleting the picture elements BP of the interspace Z, a reduced image grid BR of the image B arises that only comprises picture elements BP that were allocated to the image blocks BB (see Figure 1c).

Arrows P of Figure 1b to Figure 1c symbolically show the imaging of the individual image blocks BB of the block grid with interspaces Z to the reduced image grid BR.

The encoding is implemented for the reduced image grid BR, i.e. only for the picture elements BP of the image blocks BB. This encoding ensues as transformation encoding according to discrete cosign transformation (DCT).

The method according to the H.263 standard is utilized as encoding method. The encoded image data CB are transmitted to the second computer R2, received thereat and decoded (Step 101; see Figure 1d).

After the decoding, potentially upon employment of inverse discrete cosign transformation according to the H.263 method, a decoded, reduced image grid DBR derives that corresponds to the reduced image grid RB (see Figure 1e).

The decoded, reduced image grid DBR is now expanded onto an expanded image grid EBR having the original size of the image B, in that the interspaces Z with the non-encoded picture elements are in turn filled between the image blocks BB (see Figure 1f).

Image blocks BB that, due to the interspaces Z, lie at the image edge BRA and do not comprise 8x8 picture elements are processed by padding, i.e. filling up the image blocks BB with encoding information by extrapolation of the picture elements BP in fact present in the image block. The filling can ensue by allocation of the

encoding information of the picture elements that were previously not contained in the image block of the image edge BRA with a constant value.

The relationships of the decoded image blocks BB in the decoded, reduced block grid BR from Figure 1e and the image blocks BB in 1f after insertion of the interspaces Z are shown by arrows P in Figure 1e and 1f.

New picture elements are inserted into the decoded, reduced block grid DBR between the decoded image segments, i.e. the image blocks BB, being inserted in conformity with the non-encoded, i.e. "omitted" picture elements BP of the encoded image.

In a last step, an interpolation filtering between the individual image blocks BB across the block edges and across the interspaces Z, i.e. over the picture elements of the interspaces Z, is implemented in the expanded image grid EBR. An interpolation of the "missing" picture elements is thus achieved.

A low-pass filtering at the block edges is implemented as filtering. A plurality of filters for different image blocks is selected according to the semantics of the individual image blocks BB. The selection of the filters ensues dependent on the motion vector of an image block, whereby the strength of the low-pass employed increases with the size of the motion vector and/or dependent on the image quality of an image block, whereby the strength of the low-pass filter employed increases with the reduction in image quality of the image block BB.

Versions of the exemplary embodiment set forth above are disclosed blow.

It is not necessary to divide the image B into image blocks BB. It is likewise possible to utilize an object-based image encoding method within the scope of the inventive method, whereby the picture elements are then grouped into a plurality of image segments having an arbitrary shape.

Further, any desired object-based or, respectively, block-based image encoding method, for example MPEG, JPEG, H.263 can be utilized, as can any desired transformation encoding, for example discrete sine transformation, a wavelet transformation or a transformation on the basis of vector quantization.

Figure 3 also symbolically shows a possibility of how the method can be integrated into the existing H.263 standard. To this end, the mechanism of what is referred to as the capability table CT according to the H.245 standard is utilized (see Figure 3). A selection as to whether the standard H.263 method or the method for image encoding expanded by the inventive method should be employed can be made via a switch element SE.

The expansion is symbolically shown by a block E in Figure 3. When the expansion is selected, then a corresponding parameter is stored in the capability table CT in the first computer arrangement R1, and is proposed in the framework of the setup of the communication connection to the second computer unit R2, which likewise comprises modules for the implementation of the H.245 standard and of the H.263 standard and of the expansion module E.

After agreement about the image encoding method to be employed has been reached between the computer arrangements R1, R2, either the method according to H.263 or the method expanded by the inventive method is employed.

The invention can clearly be seen therein that the transmission of image lines and image columns between image segments, for example between image blocks, is foregone in the method. The block grid given employment of a block-based image encoding method is spread such that interspaces remain between the image blocks to be encoded and the interspaces are interpolated after the decoding.

The following publications were cited within the framework of this document:

[1] S. Hofmeir, Multimedia fur unterwegs, Funkschau, No. 7, pp. 75-77, 1996

[2] D. Le Gall, MPEG: A Video Compression Standard for Multimedia applications, Communications of the ACM, Vol. 34, No. 4, pp. 47-58, April 1991

[3] Ming Liou, Overview of the px64 kbit/s Video Coding Standard, Communications of the ACM, Vol. 34, No. 4, pp. 60-63, April 1991

[4] G. Wallace, The JPEG Still Picture Compression Standard, Communications of the ACM, Vol. 34, No. 4, pp. 31-44, April 1991

[5] W. Gerod et al, Spatial Shaping: A fully compatible Improvement of DCT-Coding, Picture Coding Symposium, Lausanne, 1993

[6] R. Kutka, A. Kaup und M. Hager, Quality Improvement of low data-rate compressed signals by pre- and postprocessing, Digital Compression Technologies and systems for Video Communications, SPIE, Vol. 2952, pp. 42-49, 07 through 09 October 1996

[7] S. Minami und A. Zakhor, An optimization approach for removing blocking effects in transform coding, IEEE Transactions on Circuit Syst. Video Technology, Vol. 5, No. 2, pp. 74-82, April 1995

[8] H.245 Standard, ITU Standard Recommendation

[9] DE 196 040 50 A1

Patent Claims [NOTA BENE: another, partly illegible, amended page of patent claims 1-3 of unknown origin and purpose is attached to the PCT Communication dated 3 August 1999]

1. Method for encoding a digitalized image with picture elements,

- whereby the picture elements are grouped into a plurality of image segments,

- whereby the grouping ensues such that at least one picture element is not allocated to an image segment for at least one part of the image between image segments, and

- whereby only the picture elements that were allocated to an image segment are encoded.

2. Method for encoding and decoding a digitalized image with picture elements,

- whereby the picture elements are grouped into a plurality of image segments in a first arrangement,

- whereby the grouping in the first arrangement ensues such that at least one picture element is not allocated to an image segment for at least a part of the image between image segments,

- whereby only the picture elements that were allocated to an image segment are encoded in the first arrangement,

- whereby the encoded image segments are transmitted from the first arrangement to a second arrangement,

- whereby the image segments are decoded in a second arrangement,

- whereby new picture elements corresponding to non-encoded picture elements of the encoded image are inserted in the second arrangement between the decoded image segments, and

- whereby an interpolation is implemented between the image segments in the second arrangement, as a result whereof encoding information is allocated to the new picture elements.

3. Method according to claim 1 or 2, whereby a filtering of the image to be encoded ensues before the encoding.

4. Method according to claim 2, whereby a low-pass filtering ensues as interpolation.

5. Method according to claim 2,

- whereby a filtering of the image to be encoded ensues before the encoding, and

- whereby a low-pass filtering ensues as interpolation.

6 Method according to claim 4 or 5, whereby the low-pass filtering ensues essentially at the image segment edges.

7. Method according to one of the claims 4 through 6, whereby an interpolation filtering ensues after the decoding.

8. Method according to claim 7, whereby the interpolation filtering essentially ensues at the image segment edges.

9. Method according to one of the claims 1 through 8, whereby the image segments are realized by image blocks.

10. Method according to claim 9, whereby at least respectively one picture element is not allocated to any image block between the image blocks.

11. Method according to one of the claims 2 through 10, whereby a plurality of filters are employed for the interpolation.

12. Method according to claim 11, whereby the selection of the filters ensues dependent on the image quality of an image block, whereby the strength of the filter employed increases with the reduction of the image quality of the image block.

13. Method according to claim 11 or 12, whereby the selection of the filters ensues dependent on the motion vector of an image block, whereby the strength of the filter employed increases with the size of the motion vector that is allocated to the respective image block.

14. Method according to one of the claims 1 through 8, whereby the encoding ensues according to the H.263 standard.

15. Method according to claim 2,

- whereby the encoding ensues according to the H.263 standard, and

- whereby the encoding is communicated from the first arrangement to the second arrangement upon employment of a capability table according to the H.245 standard.

16. Method according to one of the claims 1 through 15, whereby a motion compensation is implemented upon employment of the digitalized image.

17. Arrangement for encoding a digitalized image having picture elements, whereby a processor unit is provided that is configured such that

- the picture elements are grouped into a plurality of image segments,
- the grouping ensues such that at least one picture element is not allocated to an image segment for at least one part of the image between image segments, and
- only the picture elements that were allocated to an image segment are encoded.

18. Arrangement for encoding and decoding a digitalized image with picture elements

- comprising a first arrangement wherein a processor unit is provided that is configured such that
  -- the picture elements are grouped into a plurality of image segments,
  -- the grouping ensues such that at least one picture element is not allocated to an image segment for at least one part of the image between image segments,
  -- only the picture elements that were allocated to an image segment are encoded,
- comprising a transmission means with which the encoded image segments are transmitted from the first arrangement to a second arrangement,
- comprising a second arrangement whereat a processor unit is provided that is configured such that
  - the image segments are decoded,
  - new picture elements corresponding to non-encoded picture elements of the encoded image are inserted between the decoded image segments, and
  - an interpolation is implemented between the image segments, as a result whereof encoding information is allocated to the new picture elements.

19. Arrangement according to claim 18, whereby the processor unit is configured such that a low-pass filtering ensues as interpolation.

20. Arrangement according to one of the claims 17 through 19, whereby the processor unit is configured such that

- the image segments are realized by image blocks, and
- at least respectively one picture element is not allocated to any image block between the image blocks.

21. Arrangement according to one of the claims 18 through 20, whereby the processor unit is configured such that a plurality of filters are employed for the interpolation.

22. Arrangement according to claim 21, whereby the processor unit is configured such that the selection of the filters ensues dependent on the image quality of an image block, whereby the strength of the filter employed increases with the reduction in the image quality of the image block.

23. Arrangement according to claim 21 or 22, whereby the processor unit is configured such that the selection of the filters ensues dependent on the motion vector of an image block, whereby the strength of the filter employed increases with the size of the motion vector that is allocated to the respective image block.

24. Arrangement according to one of the claims 17 through 23, whereby the processor unit is configured such that the encoding ensues according to the H.263 standard.

25. Arrangement according to claim 19, whereby the processor unit is configured such that

- the encoding ensues according to the H.263 standard, and
- the encoding is communicated from the first arrangement to the second arrangement upon employment of a capability table according to the H.245 standard.

26. Method according to one of the claims 17 through 25, whereby the processor unit is configured such that a motion compensation is implemented upon employment of the digitalized image.

Abstract

Method for Encoding and Decoding a Digitalized Image with Picture Elements

A method and an arrangement for the implementation of the method are proposed, whereby a digitalized image with picture elements is allocated to a plurality of image segments. The image segments, preferably image blocks BB, are spread such that interspaces (Z) remain between the image blocks (BB) to be encoded. The interspaces (Z) are interpolated after the decoding.

Figure 1

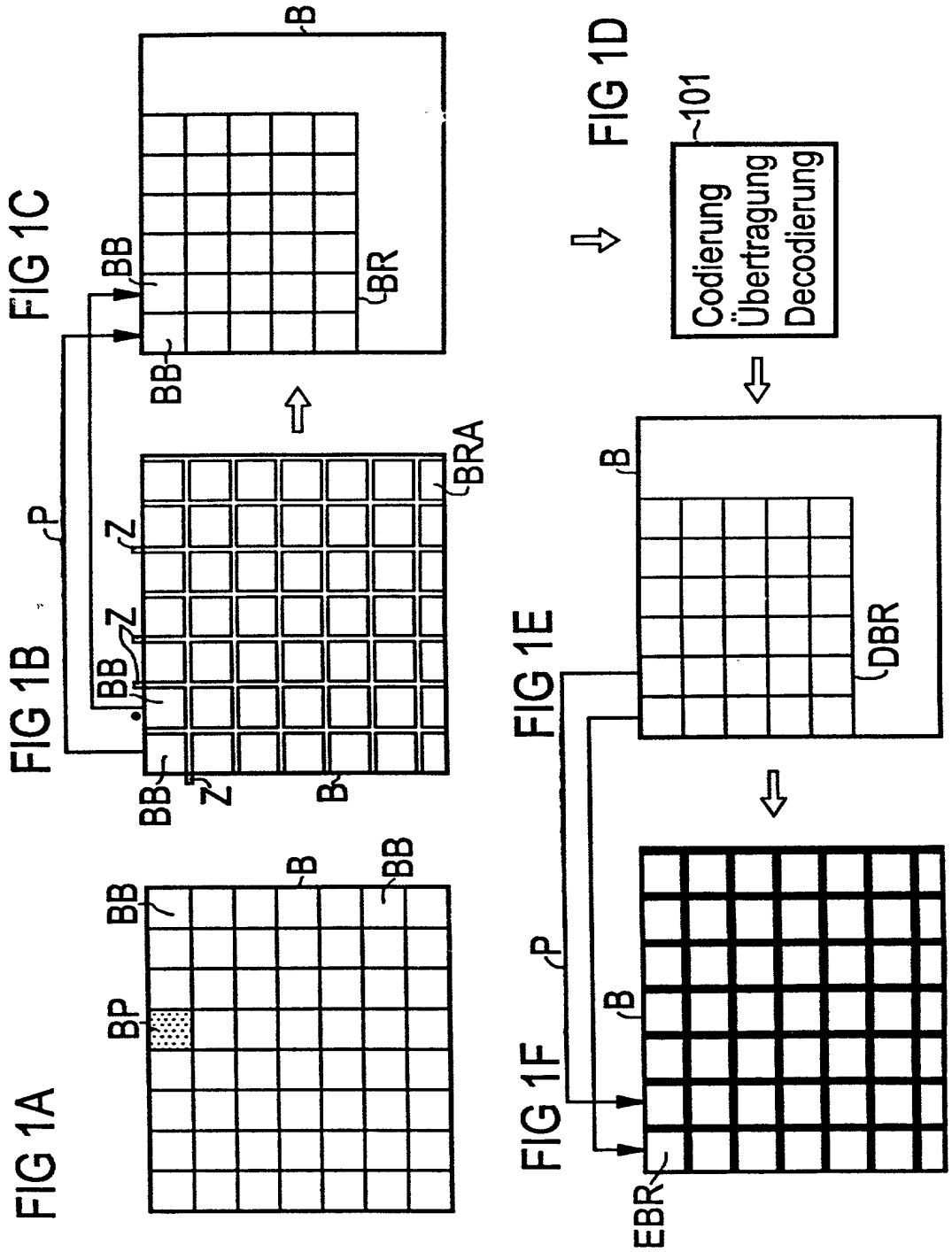


FIG 1A
BB
B
BB
BP
FIG 1B
P
Z
BB
Z
BB
Z
B
BRA
FIG 1C
B
BB
BR
BB
FIG 1D
101
Codierung
Übertragung
Decodierung
FIG 1E
B
DBR
FIG 1F
P
B
EBR

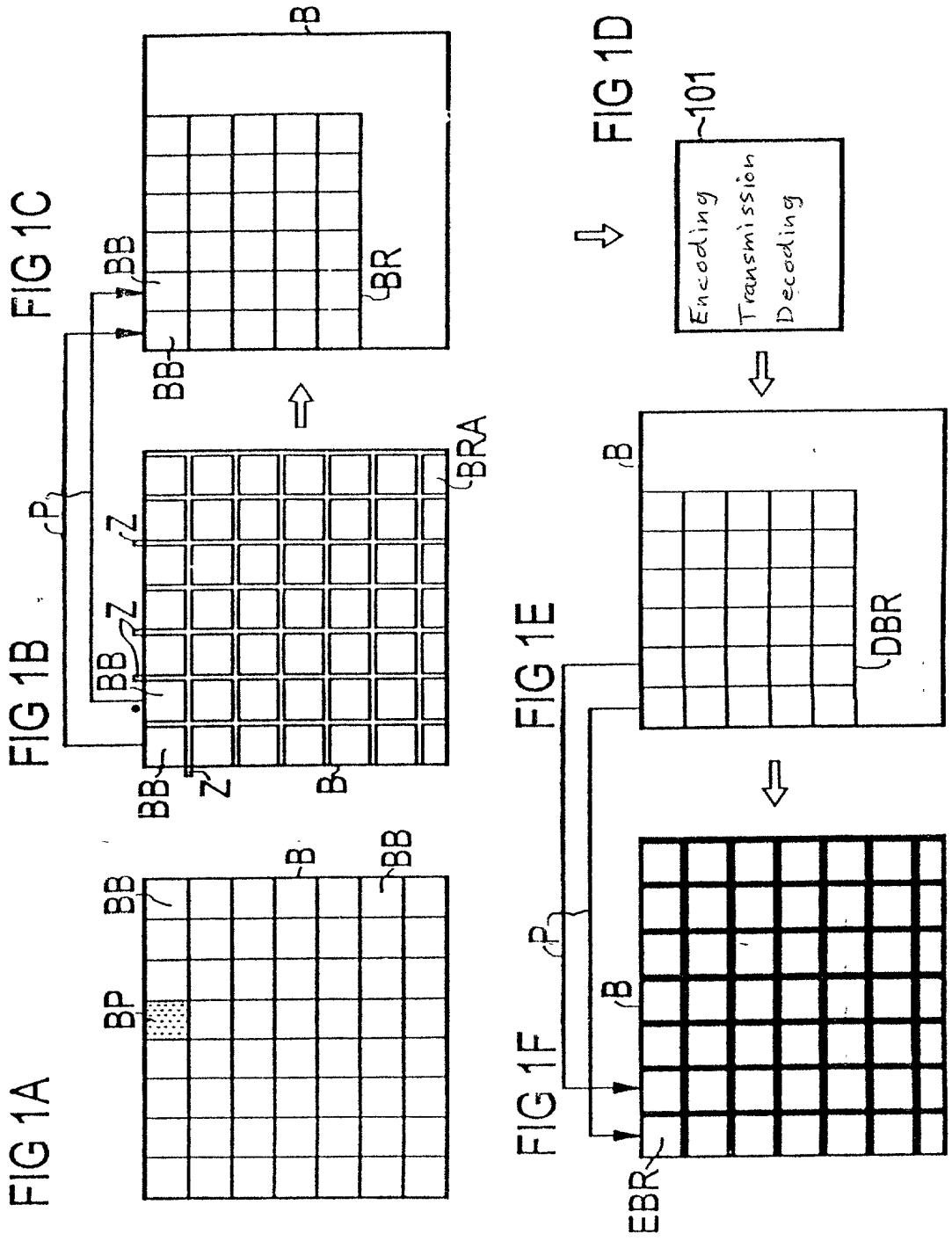
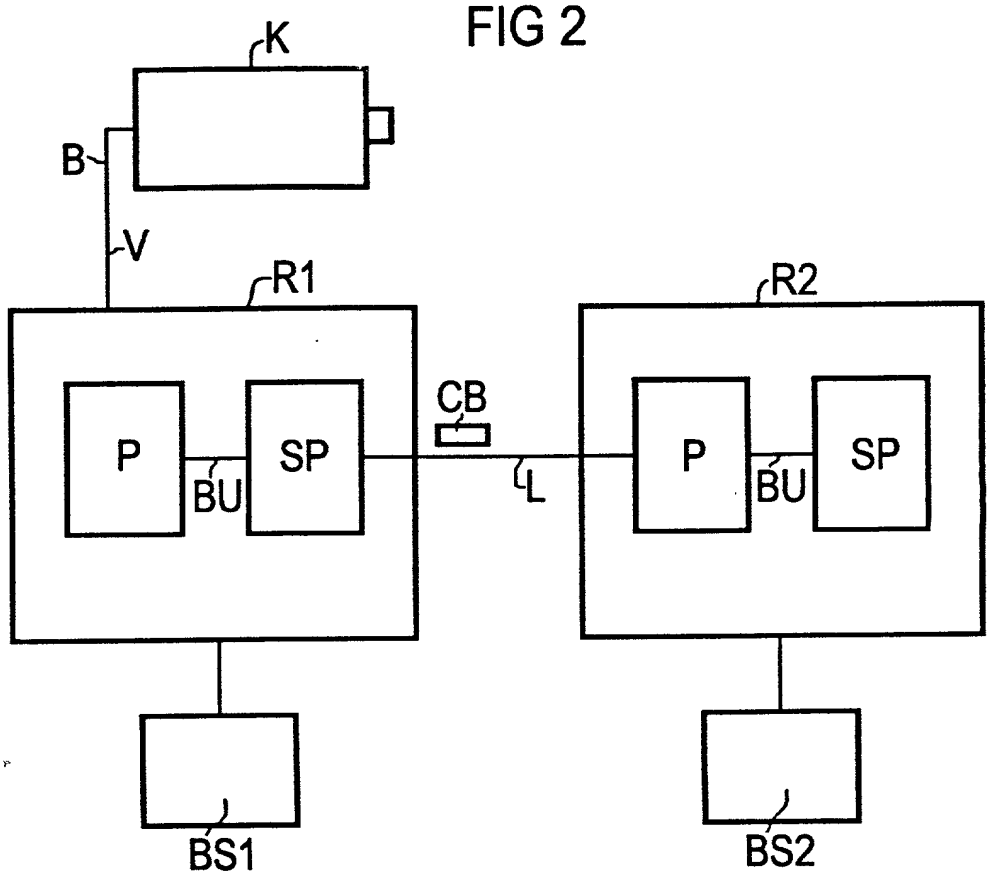


FIG 1A
BB
BP
B
BB
FIG 1B
P
Z
BB
Z
BB
Z
B
BRA
FIG 1C
B
BB
BR
BB
FIG 1D
101
Encoding
Transmission
Decoding
FIG 1E
B
DBR
FIG 1F
P
B
EBR

FIG 2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B
V
R1
R2
P
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CB
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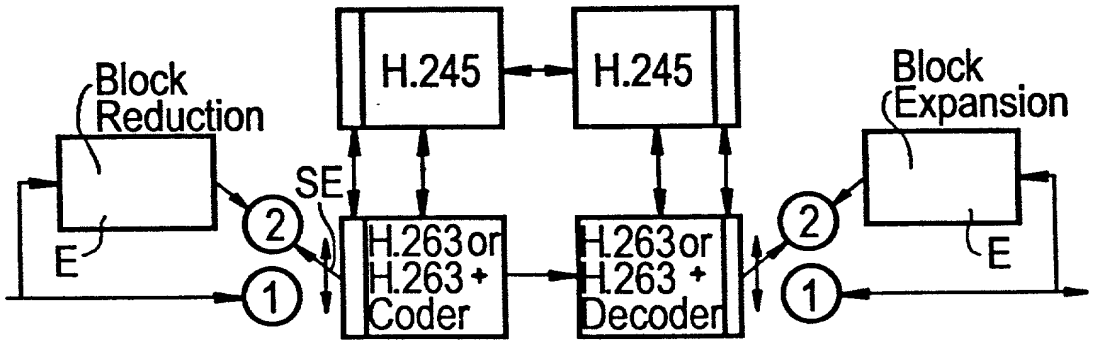
SP
BS1
BS2

FIG 3


H.245
H.245
Block Reduction
Block Expansion
SE
2
1
E
H.263 or H.263 + Coder
H.263 or H.263 + Decoder
2
1
E

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(check one)
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☐ was filed on _____ as
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PCT Application No. _____
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Prior foreign appplications
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			Priority Claimed	
197 19 470.2	Germany	07. Mai 1997	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

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And I hereby appoint

Messrs. John D. Simpson (Registration No. 19,842) Lewis T. Steadman (17,074), William C. Stueber (16,453), P. Phillips Connor (19,259), Dennis A. Gross (24,410), Marvin Moody (16,549), Steven H. Noll (28,982), Brett A. Valiquet (27,841), Thomas I Ross (29,275), Kevin W. Guynn (29,927), Edward A. Lehmann (22,312), James D. Hobart (24,149), Robert M. Barrett (30,142), James Van Santen (16,584), J Arthur Gross (13,615), Richard J. Schwarz (13,472) and Melvin A. Robinson (31,870), David R. Metzger (32,919), John R. Garrett (27,888) all members of the firm of Hill, Steadman & Simpson, A Professional Corporation.

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85th Floor Sears Tower, Chicago, Illinois 60606

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Voller Name des einzigen oder ursprünglichen Erfinders:	Full name of sole or first inventor:
Robert Kutka	
Unterschrift des Erfinders / Datum: 4.5.98	Inventor's signature / Date
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Staatsangehörigkeit: Bundesrepbulik Deutschland	Citizenship
Postanschrift: Hainbuchenstraße 3	Post Office Addess
D-82269 Geltendorf Bundesrepublik Deutschland	
Voller Name des zweiten Miterfinders (falls zutreffend): Stathis Paris	Full name of second joint inventor, if any:
Unterschrift des Erfinders / Datum: 1/6/98	Second Inventor's signature / Date
Wohnsitz: CY-3090 Limassol, Zypern CY	Residence
Staatsangehörigkeit: Zypern	Citizenship
Postanschrift: Georgiou Fasoulioti Str. 19	Post Office Address
CY-3090 Limassol Zypern	

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(Supply similar information and signature for third and subsequent joint inventors).

United States Patent & Trademark Office

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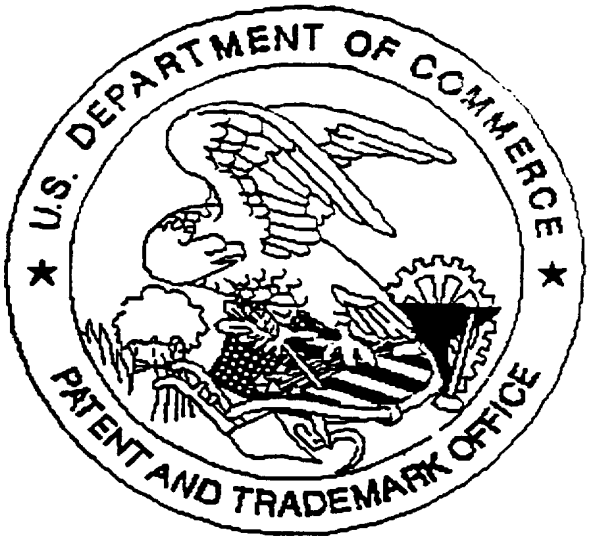

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